CLAIMS

What is claimed is:

1. A mold assembly operable to form a composite material, the mold assembly comprising:

a first mold member; and

a second mold member operable to join with said first mold member to form a mold cavity,

wherein at least a portion of one of said mold members is a porous gas-permeable material operable to vent therethrough gaseous reactants resulting from chemical reactions occurring in said cavity during a molding operation while preventing recombination and condensation of said gaseous reactants within said portion.

2. The mold assembly of Claim 1, wherein said gas-permeable material has a porosity between about 5 to 25% and an average pore diameter between about 1 to 280 microns.

3. The mold assembly of Claim 2, wherein said gas-permeable material has an average pore diameter of about 15 microns and a total porosity of about 15%.

4. The mold assembly of Claim 2, wherein said gas-permeable material is a metallic material.

5. The mold assembly of Claim 4, wherein said metallic gas-permeable material is aluminum.

6. The mold assembly of Claim 1, wherein at least a portion of one of said mold members is operable to heat said mold cavity.

7. The mold assembly of Claim 1, wherein said gas-permeable material is operable at temperatures less than about 210 degrees Celsius.

8. The mold assembly of Claim 1, wherein said gas-permeable material is operable at pressures between about 200 to 2,000 kg_f/cm^2.

9. The mold assembly of Claim 1, wherein the molded composite material is at least one of a friction material, phenolic resin, and a large reinforcement containing structure component.

10. A method of molding a composite material, the method comprising:

(a) introducing ingredients of the composite material into a mold cavity of a mold assembly;

(b) closing said mold cavity;

(c) reacting at least a portion of said ingredients in said closed mold cavity; and

(d) venting gaseous reactants resulting from said reaction through a porous gas-permeable portion of said mold assembly.

11. The method of Claim 10, wherein (d) includes venting said gaseous reactants through a porous gas-permeable sintered aluminum portion of said mold assembly.

12. The method of Claim 11, wherein (d) includes venting said gaseous reactants through a micro-porous sintered aluminum portion of said mold assembly, having an average pore diameter of about 15 microns and a total porosity of about 15%.

13. The method of Claim 10, further comprising preventing condensation and recombination of said gaseous reactants in pores of said porous gas-permeable portion of said mold assembly during venting.

14. The method of Claim 13, wherein preventing condensation and recombination includes maintaining a temperature of said portion of said mold assembly above a minimum predetermined temperature necessary to prevent condensation and recombination of said gaseous reactants in said pores.

15. The method of Claim 10, further comprising preventing decomposition of said ingredients.

16. The method of Claim 15, wherein preventing decomposition includes maintaining a temperature of said gas-permeable portion of said mold assembly below a maximum predetermined decomposition temperature of said ingredients.

17. The method of Claim 10, wherein (d) includes venting said gaseous reactants through a porous gas-permeable portion of said mold assembly having a porosity between about 5 to 25%.

18. The method of Claim 10, wherein (d) includes venting said gaseous reactants through a porous gas-permeable portion of said mold assembly having an average pore diameter between about 1 to 280 microns.

19. The method of Claim 10, further comprising maintaining a temperature of said gas-permeable portion of said mold assembly less than about 210 degrees Celsius.

20. The method of Claim 10, further comprising maintaining a pressure in said mold cavity between about 200 to 2,000 kg_f/cm^2.

21. The method of Claim 10, wherein (a) includes introducing ingredients of at least one of a friction material, a phenolic resin, and a reinforcement-containing structure component.

22. The method of Claim 10, wherein (d) includes venting through a porous gas-permeable metallic portion of said mold body.

23. A method of molding a friction material product wherein chemical reactions take place within a mold cavity releasing gaseous reactants, the method comprising:

(a) placing ingredients of the friction material into the mold cavity of a mold assembly;

(b) closing the mold cavity;

(c) pressurizing said mold cavity;

(d) heating said ingredients in the mold cavity;

(e) reacting said ingredients in the mold cavity;

(f) venting the gaseous reactants resulting from said reaction through a porous gas-permeable portion of said mold assembly while maintaining said mold cavity in a closed state; and

(g) removing a molded friction material product.

24. The method of Claim 23, wherein (f) includes venting the gaseous reactants through a porous gas-permeable portion of said mold assembly having a porosity between about 5 to 25%.

25. The method of Claim 23, wherein (f) includes venting the gaseous reactants through a porous gas-permeable portion of said mold assembly having an average pore diameter between about 1 to 280 microns.

26. The method of Claim 23, wherein (f) includes venting the gaseous reactants through a porous gas-permeable sintered aluminum portion of said mold assembly having an average pore diameter of about 15 microns and a total porosity of about 15%.

27. The method of Claim 23, further comprising preventing condensation and recombination of the gaseous reactants in pores of said porous gas-permeable portion of said mold assembly during venting by maintaining a temperature of said portion of said mold assembly above a minimum predetermined temperature.

28. The method of Claim 23, further comprising preventing decomposition of said ingredients by maintaining a temperature of said gas-permeable portion of said mold assembly below a maximum predetermined decomposition temperature of said ingredients.

29. The method of Claim 23, further comprising controlling a rate of reaction of said ingredients by maintaining a temperature of said gas-permeable portion of said mold assembly within a predetermined temperature range.

30. The method of Claim 23, further comprising maintaining a temperature of said gas-permeable portion of said mold assembly less than about 210 degrees Celsius and maintaining a pressure in the mold cavity between about 200 to 2,000 kg_f/cm^2.

31. The method of Claim 23, wherein (a) includes introducing ingredients of a friction material including phenolic resins which upon reacting generate gaseous reactants including ammonia and formaldehyde.